US009410393B2

(12) **United States Patent**
Larson et al.

(10) **Patent No.: US 9,410,393 B2**
(45) **Date of Patent: Aug. 9, 2016**

(54) **PRESSURE ASSISTED BLOWOUT PREVENTER**

(71) Applicant: **Hydril USA Manufacturing LLC**, Houston, TX (US)

(72) Inventors: **Eric Dale Larson**, Houston, TX (US); **Brian Scott Baker**, Houston, TX (US)

(73) Assignee: **Hydril USA Distribution LLC**, Houston, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/104,898**

(22) Filed: **Dec. 12, 2013**

(65) **Prior Publication Data**

US 2015/0167417 A1 Jun. 18, 2015

(51) **Int. Cl.**

E21B 33/06	(2006.01)
E21B 7/12	(2006.01)
F15B 15/26	(2006.01)
E21B 29/12	(2006.01)
F16D 31/02	(2006.01)
E21B 29/00	(2006.01)
E21B 34/04	(2006.01)

(52) **U.S. Cl.**

CPC ***E21B 33/061*** (2013.01); ***E21B 33/062*** (2013.01); ***E21B 34/04*** (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,854,058	A		4/1932	Otis	
3,743,013	A		7/1973	Harbonn	
3,933,338	A		1/1976	Herd et al.	
4,440,232	A	*	4/1984	LeMoine	E21B 34/16 166/373
5,735,502	A		4/1998	Levett et al.	
6,164,619	A	*	12/2000	Van Winkle	E21B 33/062 137/112
7,195,224	B2	*	3/2007	Le	F15B 15/261 251/1.3
7,628,207	B2	*	12/2009	Leonardi	E21B 33/038 166/344
2003/0024705	A1		2/2003	Whitby et al.	
2007/0137866	A1		6/2007	Ravensbergen et al.	
2012/0205561	A1		8/2012	Baugh	
2012/0279603	A1		11/2012	Swist	

FOREIGN PATENT DOCUMENTS

DE	2538640	A1	3/1977
KR	20130089460	A	8/2013

OTHER PUBLICATIONS

PCT Search Report and Written Opinion issued in connection with corresponding Application No. PCT/US2014/066534 on Mar. 26, 2015.

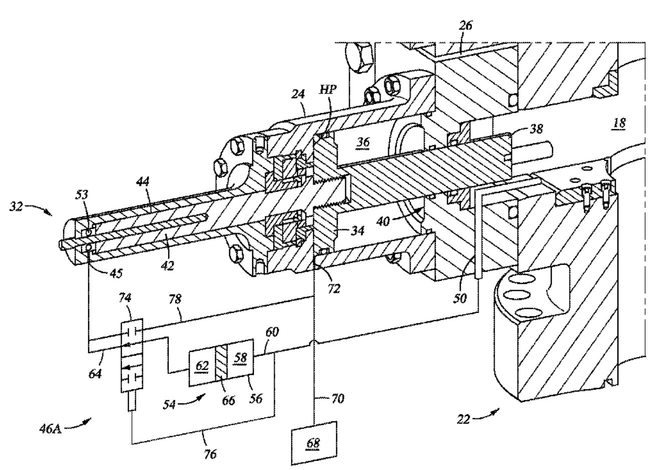
* cited by examiner

Primary Examiner — Matthew R Buck
Assistant Examiner — Douglas S Wood
(74) *Attorney, Agent, or Firm* — Bracewell LLP

(57) **ABSTRACT**

A blowout preventer (BOP) includes a pressure driven operator that is equipped with a balancing circuit to offset pressure inside the BOP. The operator, which is used to drive a ram, includes a piston, coupled to the ram by an operator arm, and a balance arm on a side of the piston opposite the operator arm. Pressure from inside the BOP communicates to an end of the balance arm opposite the piston and exerts a force to drive the ram radially inward.

18 Claims, 5 Drawing Sheets



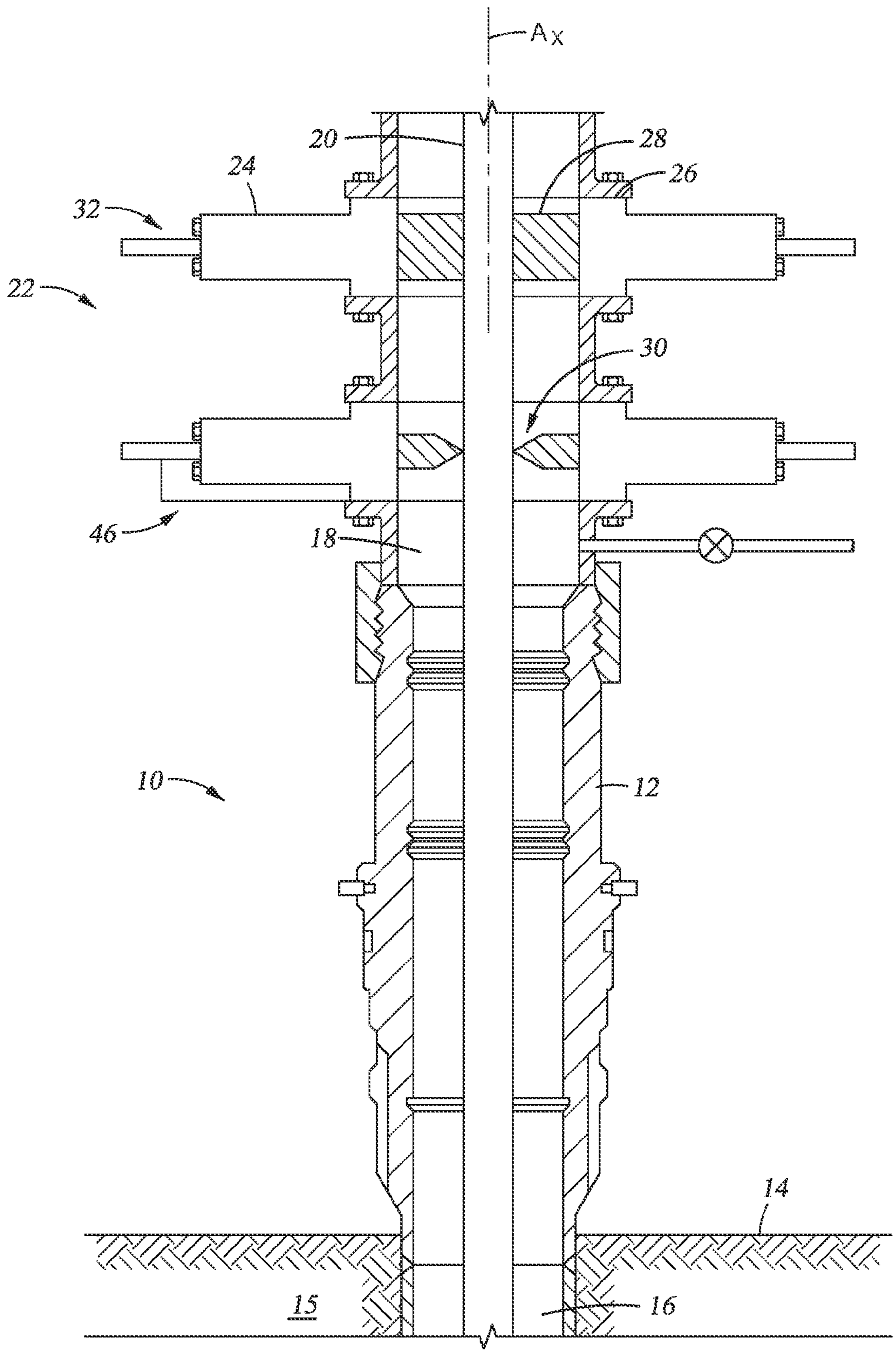


Fig. 1

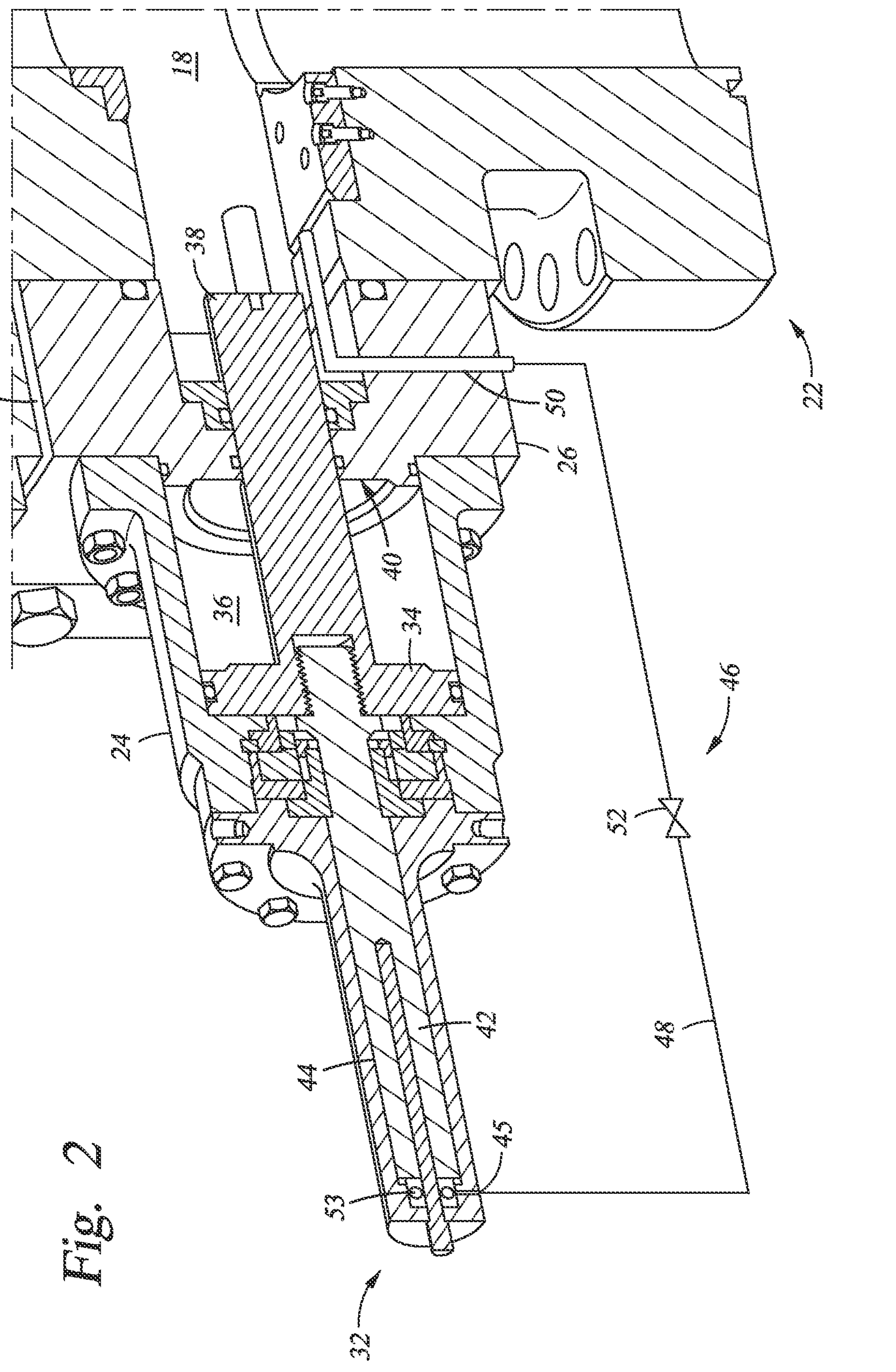


Fig. 2

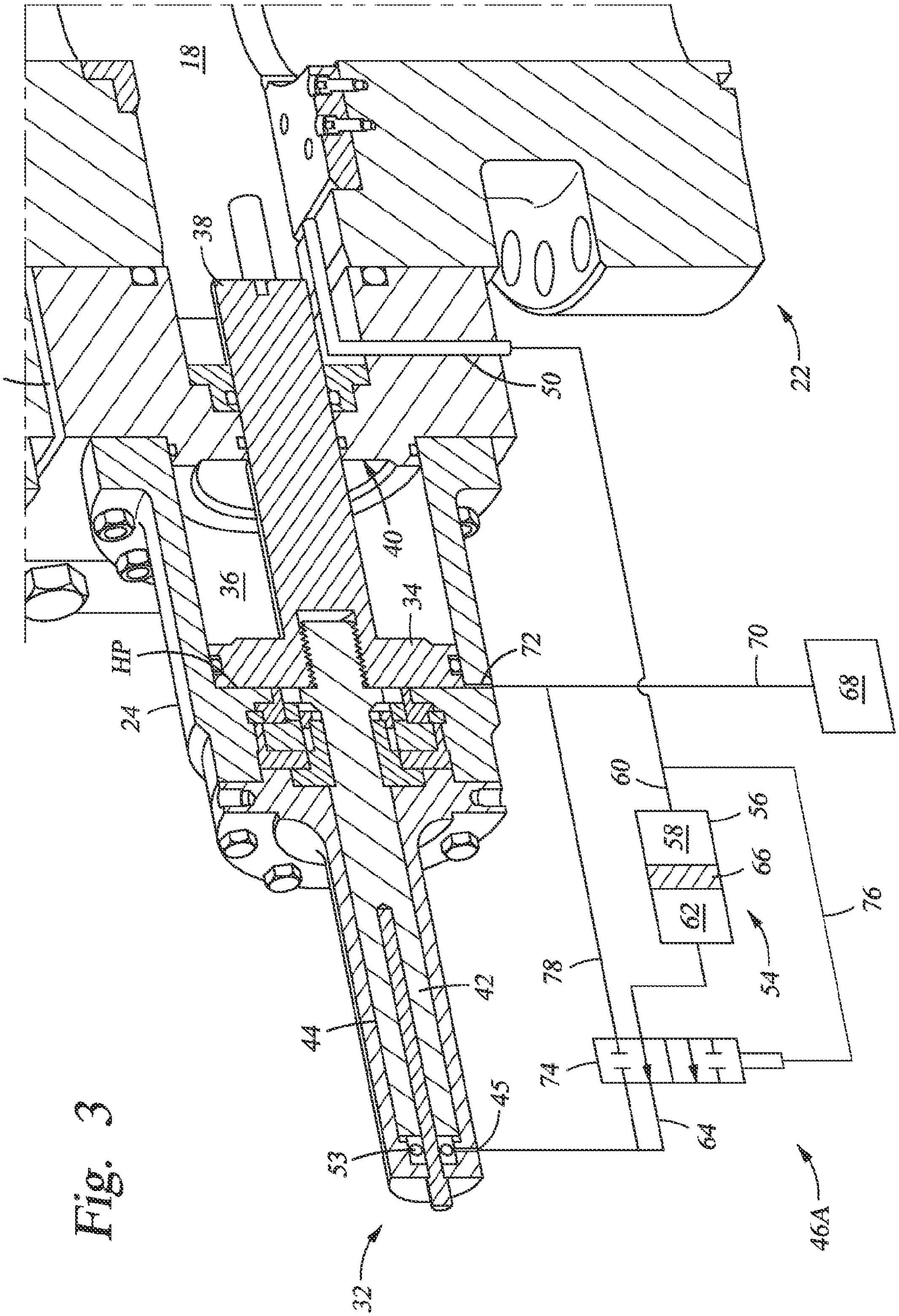

18
26
38
50
22
40
36
34
72
70
68
HP
24
60
56
58
66
62
54
76
78
74
42
44
45
53
64
46A
32

Fig. 3

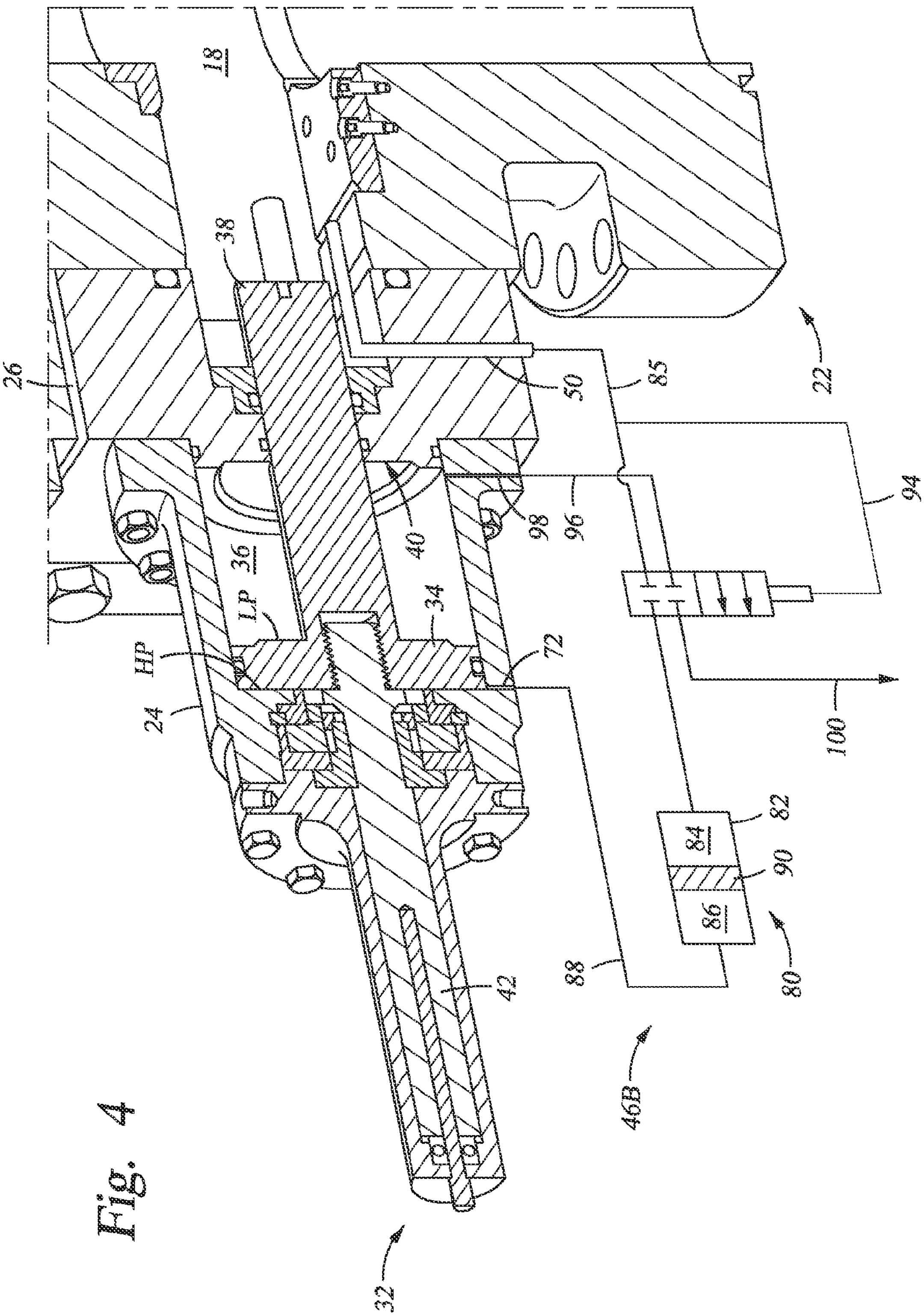

18
38
26
50
85
22
40
98
96
94
36
LP
34
72
HP
24
100
82
84
90
86
80
88
42
46B
32

Fig. 4

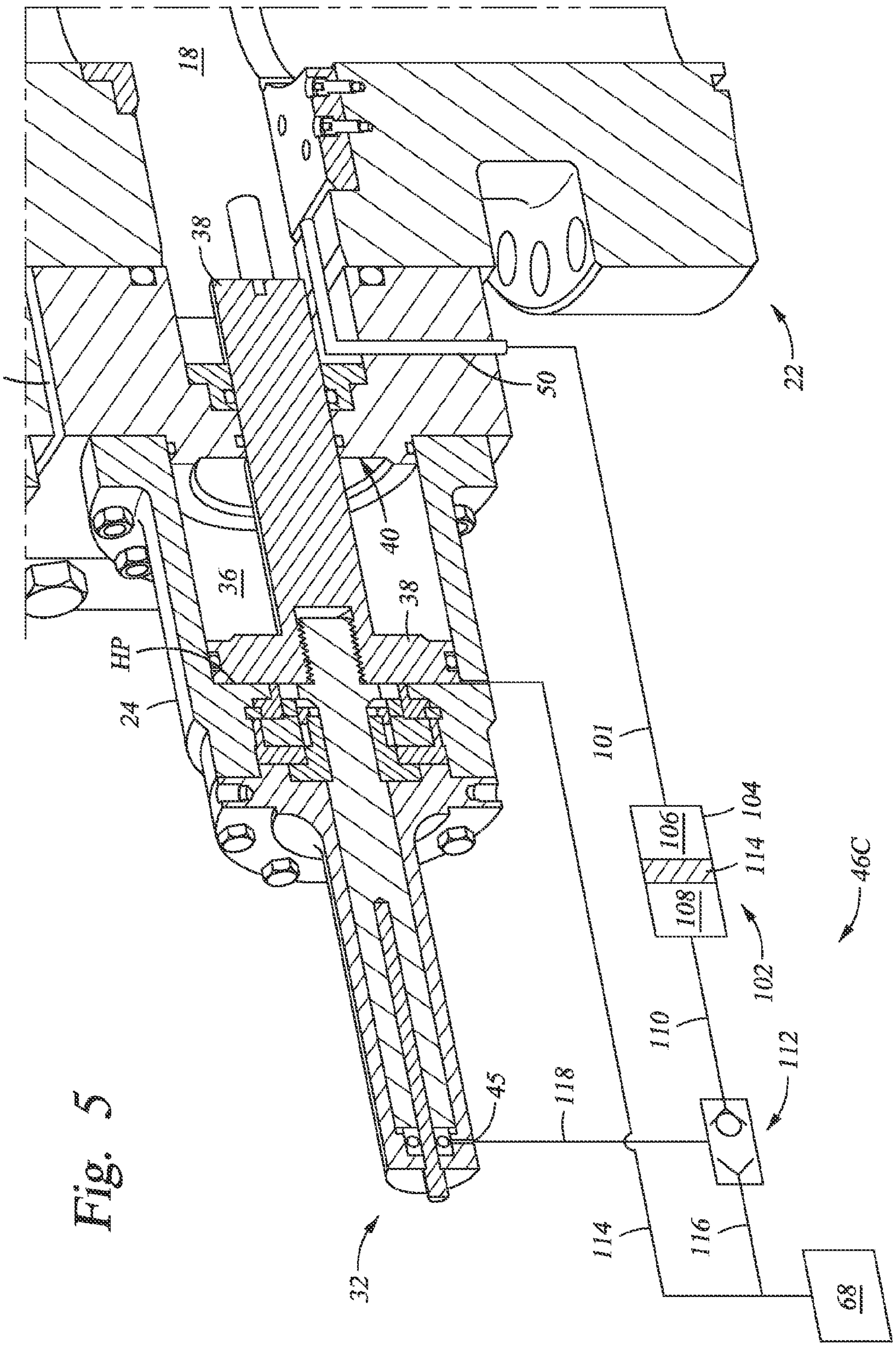

18
38
26
50
22
40
36
38
HP
24
101
106
104
114
108
46C
102
110
112
45
118
32
114
116
68

Fig. 5

PRESSURE ASSISTED BLOWOUT PREVENTER

BACKGROUND OF THE INVENTION

1. Field of Invention

The present disclosure relates in general to pressure assisted blowout preventer, and more specifically relates to using wellbore pressure to assist actuation of an operator in a blowout preventer.

2. Description of Prior Art

Wellbores in hydrocarbon bearing subterranean formations are formed by rotating a drill bit mounted on a lower end of a drill string. Typically, a wellhead housing is installed at the earth's surface and through which bit and string are inserted. A blow out preventer (BOP) stack usually mounts on top of the wellhead housing that provides pressure control of the wellbore, and often includes rams to shut in the wellbore should pressure in the wellbore become uncontrollable. Additional rams are often included with BOP stacks that are for shearing the string within the BOP stack, and also for pressure testing within the BOP. Further typically included with BOP stacks are flow lines and valves to allow fluid flow through the BOP stack for remediating overpressure in the wellbore.

Wellbore pressure communicates to inside the wellhead, and thus to the BOP; which generates a force that opposes ram and packer actuation. Pressure increases in the wellbore further increasing the force opposing ram and packer movement, thereby increasing the amount of force required for actuating the ram and packer. Rams and packers are generally hydraulically powered, and often by systems having limited capacity. Because a typical BOP is regularly tested, the resistive force created by wellbore pressure results in more frequent replenishment of the system, or installing actuation systems having larger capacity. Hydraulic systems with large capacity are not only costly, but impractical in some subsea applications.

SUMMARY OF THE INVENTION

Disclosed herein are example embodiments of a blowout preventer (BOP) with a hydraulic equalizing circuit, and methods of actuating a ram. An example embodiment of a BOP includes an annular body having a main bore in pressure communication with a wellbore, an operator assembly having an end that selectively projects radially into the body, a piston coupled with the operator assembly, and a balance rod coupled to a side of the piston distal from the main bore, and having a pressure surface in selective pressure communication with the main bore. The BOP may further include a piping circuit for providing selective communication between the pressure surface of the balance rod and the main bore. In this example, the piping circuit includes an accumulator vessel with opposite ends respectively in pressure communication with the main bore and the pressure surface of the balance rod, and a piston in the accumulator vessel that defines a fluid seal between the opposite ends, so that when pressure in the main bore is communicated to the pressure surface through the accumulator, the piston blocks fluid flow between the main bore and pressure surface. Further included in this example is a selector valve for controlling flow in a fluid path between the accumulator vessel and pressure surface of the balance rod and that is responsive to pressure in the main bore. An example of the selector valve allows pressure communication between the accumulator vessel and the pressure surface when the pressure in the main bore is above a designated pressure, and blocks pressure communication

between the accumulator vessel and the pressure surface when the pressure in the main bore is below a designated pressure. In an alternative, the selector valve provides pressure communication between the pressure surface and a pressure source for driving piston when the pressure in the main bore is below a designated pressure. The piston can optionally be reciprocatingly disposed in a cavity of a cylinder. Examples exist wherein the balance rod is an elongate member that is substantially coaxial with the piston and inserts into a sealed plenum having a port that is in a path of fluid communication between the main bore and the pressure surface. In an alternative, the pressure surface is disposed in a plane that is generally parallel with an axis of the main bore. A ram is optionally mounted on the end of the operator assembly that projects radially into the body.

Another example of a BOP includes an annular body having a main bore in pressure communication with a wellbore, an operator assembly having an operational end that selectively projects radially inward into the annular body and into shearing contact with a tubular in the main bore, a pressure surface coupled with the operator assembly that faces radially outward from the operational end, and that is in selective pressure communication with the main bore. The pressure surface can be on a piston that is reciprocatingly disposed in a cylinder mounted to the annular body, so that exposing the pressure surface to pressure in the main bore, urges the piston radially inward to push the operational end into shearing contact with the tubular. Optionally, a piston can be coupled with the operator assembly and extend radially outward therefrom, and an elongate balance arm can be coupled to a side of the piston distal from the operator assembly, and wherein the pressure surface is on an end of the balance arm distal from the piston. In this example the side of the piston facing the balance arm is selectively pressurized to generate a piston force for urging the piston radially inward, and wherein the piston force is greater than a force exerted onto the pressure surface by communicating pressure from the main bore. The pressure between the main bore and pressure surface can be communicated through a piping circuit that comprises an accumulator having a piston that separates fluid from the main bore with fluid in the piping circuit that is in contact with the pressure surface. The BOP can further include a selector valve for selectively providing communication between the main bore and the pressure surface when pressure in the main bore is above a designated value, and blocking communication between the main bore and the pressure surface when pressure in the main bore is below a designated value. In this example, the pressure surface is on a piston that is reciprocatingly disposed in a cylinder mounted to the annular body, so that exposing the pressure surface to pressure in the main bore, urges the piston radially inward to push the operational end into shearing contact with the tubular, and wherein the selector valve diverts fluid in a low pressure side of the cylinder to ambient when the piston is urged radially inward.

An example method of actuating a ram in a BOP includes providing an operator assembly comprising operator arm that couples with the ram, and a pressure surface coupled with the operator arm that faces radially away from the ram, and selectively providing pressure communication between a main bore in the BOP and the pressure surface that generates a force which urges the operator arm and ram radially inward. In the method, a piston can be coupled with the operator arm, and wherein the pressure surface is disposed on a side of the piston facing away from the ram. Optionally in the method, a piston can be coupled with the operator arm and a balance arm can extend from the piston radially away from the ram, and wherein the pressure surface is on a portion of the balance arm distal from the ram, the method further comprising communicating pressure from a pressure source onto a surface of the piston facing away from the ram.

BRIEF DESCRIPTION OF DRAWINGS

Some of the features and benefits of the present invention having been stated, others will become apparent as the description proceeds when taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a side partial sectional view of an wellhead assembly with an example of a blowout preventer (BOP) in accordance with the present disclosure.

FIG. **2** is a sectional perspective view of an example of a portion of the BOP of FIG. **1** equipped with an embodiment of a fluid balancing circuit and in accordance with the present disclosure.

FIG. **3** is a sectional perspective view of the portion of the BOP of FIG. **2** and with an alternate embodiment of the fluid balancing circuit and in accordance with the present disclosure.

FIG. **4** is a sectional perspective view of the portion of the BOP of FIG. **2** and with an alternate embodiment of the fluid balancing circuit and in accordance with the present disclosure.

FIG. **5** is a sectional perspective view of the portion of the BOP of FIG. **2** and with an alternate embodiment of the fluid balancing circuit and in accordance with the present disclosure.

While the invention will be described in connection with the preferred embodiments, it will be understood that it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alternatives, modifications, and equivalents, as may be included within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF INVENTION

The method and system of the present disclosure will now be described more fully hereinafter with reference to the accompanying drawings in which embodiments are shown. The method and system of the present disclosure may be in many different forms and should not be construed as limited to the illustrated embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey its scope to those skilled in the art. Like numbers refer to like elements throughout.

It is to be further understood that the scope of the present disclosure is not limited to the exact details of construction, operation, exact materials, or embodiments shown and described, as modifications and equivalents will be apparent to one skilled in the art. In the drawings and specification, there have been disclosed illustrative embodiments and, although specific terms are employed, they are used in a generic and descriptive sense only and not for the purpose of limitation.

FIG. **1** illustrates in side partial sectional view an example of a wellhead assembly **10**, which is made up of an annular wellhead housing **12** shown mounted into a surface **14**. The surface **14** may be subsea or on ground, and is over a formation **15** intersected by a wellbore **16**. The wellhead assembly **10** is mounted over wellbore **16**. A main bore **18** extends axially within wellhead assembly **10**, and is in communication with wellbore **16**. A drill string **20** is shown inserted into main bore **18**; and in the example of FIG. **1** is aligned with an axis A_X of wellhead assembly **10**. Wellhead assembly **10** of FIG. **1** includes a blowout preventer (BOP) **22** mounted on an upper end of wellhead housing **12**. BOP **22** includes cylinders **24**, and a main body **26**, where cylinders **24** are shown attached on an outer surface of a main body **26** of BOP **22**. In the example of FIG. **1**, cylinders **24** have a circular outer surface and project radially outward from body **26**. Cylinders **24** include operational assemblies for actuating a packer **28** shown projecting radially inward into contact with an outer surface of drill string **20**. Optionally, shear rams **30** can be actuated with operational assemblies in cylinders **24**. As will be described in greater detail below, plenums **32** project radially outward from ends of cylinders **24** distal from body **26**. Plenums **32** are elongate with a generally circular outer surface, and have outer diameters less than diameters of cylinders **24**.

FIG. **2** shows in side perspective view a portion of BOP **22** and an example cylinder **24**. A planar piston **34** is shown mounted within a cavity **36** provided within cylinder **24**, and which can reciprocate within cavity **36** and coaxially to cylinder **24**. An elongate operator arm **38** couples with and extends radially inward from piston **34**, and which an example can be used for actuating one or both of the packer **28** or rams **30** (FIG. **1**). In the example of FIG. **2**, piston **34** is in a portion of cavity **36** distal from the main body **26**, when piston **34** is located as shown, the packer **28** or ram **30** are in respective unactivated positions. As will be discussed in more detail below, urging the piston **34** in the cavity **36** to proximate to main body **26**, moves the operator arm **38** radially inward towards axis A_X, for activating packer **28** or ram **30**. A bore **40** is formed radially through a portion of body **26** to allow operator arm **38** to project from cylinder **36** and into a portion of BOP **20** in pressure communication with main bore **18**. Seals are shown provided on a surface of bore **40** creating a pressure seal between operator arm **38** and bore **40**.

A balance arm **42** is shown coupled with a side of piston **34** opposite its attachment to operator arm **38**. Balance arm **42** is generally elongate and projects radially outward from piston **34** along a path generally coaxial with piston **34** and operator arm **38**. Balance arm **42** extends from cavity **36** into a cavity **44** formed within plenum **32**. Seal between balance arm **42** and cavity **44** isolates end of balance arm **42** from cavity **36**. A port **45** is formed through a sidewall of plenum **32** and provides a pressure communication path between cavity **44** and a piping circuit **46** that provides selective pressure communication with main bore **18**. Piping circuit **46** is made up of a line **48** having an end that connects to port **45**, and has an opposite end connecting to a passage **50** formed in main body **26**. An end of passage **50** opposite its connection with line **48** communicates with main bore **18**. A valve **52** is provided in line **48** for controlling pressure communication through line **48**, thereby selectively providing pressure communication between main bore **18** and cavity **44**. As such, in one example of operation, valve **52** may be selectively opened so that pressure in main bore **18** can be applied to an end of balance arm **44** distal from piston **34**, and in turn exert a force onto balance arm **42**, thereby assisting piston **34** to urge operator arm **38** radially inward. In this example, a pressure surface **53** is defined on the end of balance arm **42** distal from piston **34**, where the application of pressure in main bore **18** onto pressure surface **53** generates the force on balance arm **42**, which counters the resistive force on the operator arm **38** produced by pressure in the main bore **18**.

FIG. **3** illustrates an alternate embodiment of fluid circuit **46**A that includes an accumulator **54** in a fluid path between main bore **18** and cavity **44**. In this example, the accumulator **54** includes an outer housing **56**. A well side **58** is defined in a portion of the accumulator **54** adjacent where a line **60** attaches to housing **56**. Line **60** provides fluid and pressure communication between passage **50** and accumulator **54**. A clean side **62** is shown in housing **56** and in a portion of accumulator **54** distal from well side **58**. A line **64** connects to housing **56** adjacent to clean side **62**, and provides selective communication between clean side **62** and port **45**. A piston **66**, which axially can reciprocate within accumulator **54**, defines a barrier between well side **58** and clean side **62**. In one example, clean side **62** and line **64** include a clean hydraulic fluid that is isolated from well side **58**, line **60**, and main bore **18**. Thus, any contaminants that may be present in main bore **18** can be blocked and/or sealed from entering plenum **44** by accumulator **54**.

Further in the example of FIG. **3**, a pressure source **68** is schematically illustrated that is in fluid communication with cavity **36** via line **70**. In the illustrated example of FIG. **3**, line **70** is shown having one end connected to pressure source **68** and a distal end connected to a port **72**, where port **72** extends through a side wall of cylinder **24** and into cavity **36**. Pressure source **68** provides a motive force for urging piston **34** radially inward and driving operator arm **38** to actuate ram **30** (FIG. **1**).

In one optional embodiment, a selector valve **74** is shown in line **64** for controlling communication between main bore **18** and cavity **44**. Operation of selector valve **74** depends on pressure in main bore **18**, which is communicated to selector valve **74** via tubing **76** shown having an upstream end connected to line **60** and a downstream end connected to a control port in selector valve **74**. In one example of operation, when pressure in main bore **18** is at least as great as pressure in pressure source **68**, selector valve **74** is positioned to allow flow through line **64**. Under these conditions, exposing plenum **44**, and thus pressure surface **53**, to pressure in main bore **18** when it is greater than pressure from pressure source **68**, increases the force exerted onto operator arm **18**, and overcomes resistive forces generated from pressure in main bore **18** that are exerted radially outward against operator arm **38**. Further shown in the example embodiment of FIG. **3** is that selector valve **74** is in line **78**, and thereby controls fluid communication between line **70** and line **64**. In an embodiment, when pressure in main bore **18** exceeds pressure in line **70** (from pressure source **68**), selector valve **74** is set to block flow through line **78** thereby isolating plenum **44** from communication with line **70**.

Still referring to FIG. **3**, in another example of operation and when pressure in main bore **18** is less than pressure in pressure source **68**, selector valve **74** is positioned to block flow through line **64**, thereby isolating plenum **44** from main bore **18**. Further in this example, selector valve **74** is selectively configured to allow flow through line **78** so that line **70** and plenum **44** are in communication, and generating a force onto balance arm **42** from pressure on pressure surface **53** supplied from pressure source **68** via lines **70**, **78**.

FIG. **4** illustrates a perspective partial sectional view of a portion of BOP **22** equipped with an alternate embodiment of piping circuit **46**B. In this example, pressure from main bore **18** is communicated directly into cavity **36** for generating a force on piston **34** that in turn is exerted radially inward against operator arm **38**. In this embodiment, although plenum **32** is shown on an outer end of cylinder **24**, examples exist where cylinder **24** does not include plenum **32** or balance arm **42**. Fluid circuit **46**B includes an accumulator **80** (similar to accumulator **54** of FIG. **3**) having a housing **82**, in which a portion is designated as a well side **84**. Line **85** connects to housing **82** adjacent well side **84** and another end to passage **50**, thereby communicating pressure in main bore **18** to well side **84**. Accumulator **80** includes a clean side **86**, which is in communication with cavity **36** via line **88** that connects to housing **82** on one end and to port **72** on its distal end. A piston **90** provides a flow barrier between well side **84** and clean side **86** so that any fluid from main bore **18** is isolated from clean side **86**, line **88**, and cavity **36**. The embodiment of the piping circuit **46**B shown in FIG. **4** further includes a selector valve **92** disposed in line **85** for controlling flow from main bore **18** and into cavity **36**. Selector valve **92** operates contingent on pressure in main bore **18**, which is communicated to selector valve **92** via tubing **94**. In the illustrated example of FIG. **4**, tubing **94** has an upstream end connected to line **85** and a downstream end connected to a control port on selector valve **92**.

An optional discharge line **96** is shown connected to a port **98** on an upstream end, where line **96** and port **98** are for dumping fluid from cavity **36** on the low pressure side LP of piston **34** when piston **34** is urged radially inward. Port **98** is formed through a side wall of cylinder **24** on a low pressure side of piston **34**, and discharge line **96** connects to selector valve **92** on a downstream end. In one example of operation, a pressure kick or other high pressure episode is experienced in main bore **18**, packer **28** (FIG. **1**) may close thereby increasing pressure in main bore **18**. In an optional embodiment, when pressure in main bore **18** reaches a designated pressure, such as the rated working pressure of packer **28**, selector valve **92** is set to a position allowing fluid communication through line **85** thereby communicating pressure from main bore **18** to the high pressure side HP of piston **34** via fluid circuit **46**B. In examples where the space in cavity **36** on the low pressure side of piston **34** includes a fluid, the selector valve may be set to vent the fluid and thus in a position allowing communication between line **96** and a discharge line **100** for allowing fluid in low pressure side of cavity **36** to vent through line **96**, selector valve **92** and exit from line **100** which enables piston to move radially inward within cylinder **24**. An advantage of the line on pressure in main bore **18** has an actuation source of operator assembly, is that leak paths and other issues with externally applied working fluid can be eliminated. Additionally, weight of the BOP can be reduced by eliminating the need for hardware, such as accumulator count requirement.

In the alternate example of FIG. **5**, circuit **46**C includes a line **101** communicating pressure in main bore **18** to accumulator **102**. Accumulator **102** includes a housing **104**, a well side **106** in housing **104** adjacent to connection to line **101**. A clean side **108** is in housing **104**, an upstream end of a line **110** connects to housing **104** adjacent clean side **108**, line **110** has a downstream end that connects to a double check valve **112**. A piston **114** in housing **104** separates well side **106** from clean side **108**. Pressure source **68** is schematically shown connected to high pressure side HP of piston **38** via line **114**. Line **116** connects line **114** to a side of check valve **112** opposite its connection to line **110**. Outlet line **118** connects check valve **112** to port **45**, thus communicating check valve **112** with plenum **32**. In an example of operation of the embodiment of FIG. **5**, when pressure in main bore **18** exceeds pressure from pressure source **68**, fluid in clean side **108** and line **110** is urged through double acting check valve **112**, through line **118** and into plenum **32** via port **45**. In this mode of operation, check valve **112** blocks from therein from line **116**. Alternatively, when pressure of fluid from pressure source **68** is greater than main bore **18**, check valve **112** blocks flow from line **110**, thereby allowing flow from line **114**, through line **116**, into check valve **112**, and into plenum **32** via line **118** and port **45**.

The present invention described herein, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned, as well as others inherent therein. While a presently preferred embodiment of the invention has been given for purposes of disclosure, numerous changes exist in the details of procedures for accomplishing the desired results. These and other similar modifications will readily suggest themselves to those skilled in the art, and are intended to be encompassed within the spirit of the present invention disclosed herein and the scope of the appended claims.

What is claimed is:

1. A blowout preventer (BOP) comprising:
   an annular body having a main bore in pressure communication with a wellbore;
   an operator assembly having an end that selectively projects radially into the body;
   a piston coupled with the operator assembly; and
   a balance rod coupled to a side of the piston distal from the main bore, and having a pressure surface in selective pressure communication with the main bore, so that the pressure on the balance rod at the pressure surface mirrors the pressure in the main bore when the pressure surface is in pressure communication with the main bore.

2. The BOP of claim 1, further comprising a piping circuit for providing selective communication between the pressure surface and the main bore.

3. The BOP of claim 2, wherein the piping circuit comprises an accumulator vessel with opposite ends respectively in pressure communication with the main bore and the pressure surface, and a piston in the accumulator vessel that defines a fluid seal between the opposite ends, so that when pressure in the main bore is communicated to the pressure surface through the accumulator, the piston blocks fluid flow between the main bore and pressure surface.

4. The BOP of claim 3, further comprising a selector valve for controlling flow in a fluid path between the accumulator vessel and pressure surface and that is responsive to pressure in the main bore.

5. The BOP of claim 4, wherein the selector valve allows pressure communication between the accumulator vessel and the pressure surface when the pressure in the main bore is above a designated pressure, and blocks pressure communication between the accumulator vessel and the pressure surface when the pressure in the main bore is below a designated pressure.

6. The BOP of claim 4, wherein the selector valve provides pressure communication between the pressure surface and a pressure source for driving piston when the pressure in the main bore is below a designated pressure.

7. The BOP of claim 1, wherein the piston is reciprocatingly disposed in a cavity of a cylinder.

8. The BOP of claim 1, wherein the balance rod is an elongate member that is substantially coaxial with the piston and inserts into a sealed plenum having a port that is in a path of fluid communication between the main bore and the pressure surface.

9. The BOP of claim 1, wherein the pressure surface is disposed in a plane that is generally parallel with an axis of the main bore.

10. The BOP of claim 1, wherein a ram is mounted on the end of the operator assembly that projects radially into the body.

11. A blowout preventer (BOP) comprising:
   an annular body having a main bore in pressure communication with a wellbore;
   an operator assembly having an operational end that selectively projects radially inward into the annular body and into shearing contact with a tubular in the main bore;
   a pressure surface coupled with the operator assembly that faces radially outward from the operational end, and that is in selective pressure communication with the main bore, so that the pressure at the pressure surface mirrors the pressure in the main bore when the pressure surface is in pressure communication with the main bore;
   wherein a piston is coupled with the operator assembly and extends outward therefrom, and an elongate balance arm couples to a side of the piston distal from the operator assembly, and wherein the pressure surface is on an end of the balance arm distal from the piston.

12. The BOP of claim 11, wherein the side of the piston facing the balance arm is selectively pressurized to generate a piston force for urging the piston radially inward, and wherein the piston force is greater than a force exerted onto the pressure surface by communicating pressure from the main bore.

13. The BOP of claim 11, wherein pressure between the main bore and pressure surface is communicated through a piping circuit that comprises an accumulator having a piston that separates fluid from the main bore with fluid in the piping circuit that is in contact with the pressure surface.

14. The BOP of claim 11, further comprising a selector valve for selectively providing communication between the main bore and the pressure surface when pressure in the main bore is above a designated value, and blocking communication between the main bore and the pressure surface when pressure in the main bore is below a designated value.

15. The BOP of claim 14, wherein the pressure surface is on a piston that is reciprocatingly disposed in a cylinder mounted to the annular body, so that exposing the pressure surface to pressure in the main bore, urges the piston radially inward to push the operational end into shearing contact with the tubular, and wherein the selector valve diverts fluid in a low pressure side of the cylinder to ambient when the piston is urged radially inward.

16. A method of actuating a ram in a blowout preventer (BOP) comprising:
   providing an operator assembly comprising an operator arm that couples with the ram, and a pressure surface coupled with the operator arm that faces radially away from the ram; and
   selectively providing pressure communication between a main bore in the BOP and the pressure surface so that the pressure on the pressure surface mirrors the pressure in the main bore when the pressure surface is in pressure communication with the main bore, and so that the pressure communication generates a force which urges the operator arm and ram radially inward, wherein a piston is coupled with the operator arm and a balance arm extends from the piston radially away from the ram, and wherein the pressure surface is on a portion of the balance arm distal from the ram.

17. The method of claim 16, wherein a piston is coupled with the operator arm, and wherein the pressure surface is disposed on a side of the piston facing away from the ram.

18. The method of claim 16, the method further comprising communicating pressure from a pressure source onto a surface of the piston facing away from the ram.

* * * * *